This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{1050}{0}} + \sqrt{210}i$$

The solution is Not a Complex Number, which is option A.

A. Not a Complex Number

* This is the correct option!

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

C. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

D. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

E. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{93636}{324}}$$

The solution is Integer, which is option E.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Irrational

These cannot be written as a fraction of Integers.

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Integer

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -306.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{193600}{400}}$$

The solution is Whole, which is option E.

A. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

C. Irrational

These cannot be written as a fraction of Integers.

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 440.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{63 - 55i}{3 + 2i}$$

The solution is $6.08 - 22.38i$, which is option A.

A. $a \in [5.5, 7]$ and $b \in [-23.5, -21]$

* $6.08 - 22.38i$, which is the correct option.

B. $a \in [19.5, 22.5]$ and $b \in [-28.5, -26.5]$

$21.00 - 27.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [5.5, 7]$ and $b \in [-293, -290.5]$

$6.08 - 291.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [22, 24]$ and $b \in [-3.5, -2.5]$

$23.00 - 3.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [78, 80.5]$ and $b \in [-23.5, -21]$

$79.00 - 22.38i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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5. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 5^2 + 17 \div 16 * 4 \div 20$$

The solution is -12.787, which is option A.

A. $[-12.81, -12.66]$

* -12.787, this is the correct option

B. $[37, 37.09]$

37.013, which corresponds to two Order of Operations errors.

C. $[-13.16, -12.83]$

-12.987, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[37.09, 37.36]$

37.212, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{72 + 66i}{-7 - i}$$

The solution is $-11.40 - 7.80i$, which is option D.

A. $a \in [-9.5, -8]$ and $b \in [-12, -9]$

$-8.76 - 10.68i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-12, -10.5]$ and $b \in [-390.5, -389]$

$-11.40 - 390.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-571, -569.5]$ and $b \in [-8, -7]$

$-570.00 - 7.80i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-12, -10.5]$ and $b \in [-8, -7]$

* $-11.40 - 7.80i$, which is the correct option.

E. $a \in [-11, -9]$ and $b \in [-68, -65.5]$

$-10.29 - 66.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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7. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{2057}{11}} + \sqrt{110}i$$

The solution is Nonreal Complex, which is option D.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Nonreal Complex

* This is the correct option!

E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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8. Simplify the expression below and choose the interval the simplification is contained within.

$$19 - 4^2 + 9 \div 3 * 17 \div 16$$

The solution is 6.188, which is option C.

A. $[33.42, 35.53]$

35.011, which corresponds to two Order of Operations errors.

B. $[2.16, 5.17]$

3.011, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[5.8, 7.07]$

* 6.188, this is the correct option

D. $[37.78, 38.61]$

38.188, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 + 10i)(-9 - 2i)$$

The solution is $65 - 80i$, which is option E.

A. $a \in [23, 27]$ and $b \in [-103, -98]$

$25 - 100i$, which corresponds to adding a minus sign in the second term.

B. $a \in [45, 46]$ and $b \in [-20, -19]$

$45 - 20i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [23, 27]$ and $b \in [93, 104]$

$25 + 100i$, which corresponds to adding a minus sign in the first term.

D. $a \in [64, 66]$ and $b \in [78, 86]$

$65 + 80i$, which corresponds to adding a minus sign in both terms.

E. $a \in [64, 66]$ and $b \in [-89, -79]$

* $65 - 80i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-6 - 2i)(4 + 9i)$$

The solution is $-6 - 62i$, which is option D.

A. $a \in [-42, -38]$ and $b \in [42, 47]$

$-42 + 46i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-27, -22]$ and $b \in [-20, -17]$

$-24-18i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-11, -3]$ and $b \in [59, 64]$

$-6+62i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-11, -3]$ and $b \in [-64, -59]$

* $-6-62i$, which is the correct option.

E. $a \in [-42, -38]$ and $b \in [-47, -42]$

$-42-46i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.
